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Magnetic Properties of La_2CuO_4 Nanoparticles

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A nano-size effect on magnetic materials shows novel and causes the magnetic properties different from those observed in a bulk form. The nano-size effect has been well investigated in metals but not yet explored in the high-Tc superconducting oxides. La₂CuO₄ (LCO) is a parental compound of La-based high-T_{*c*} superconducting cuprates which have a long-range antiferromagnetic (AF) ordering of Cu spins. LCO nanoparticles were synthesized using the sol-gel method by controlling the time and temperature of a sintering process. It was found from our zero-field μSR on LCO nanoparticles that the magnetic transition temperature drastically decreased with decreasing the particle size. On the other hand, the saturated internal field at the muon site did not change at all, suggesting that the AF spin alignment around the muon in the nanoparticle state is the same as in the bulk sample. We proposed a core-shell model to understand our μSR results. We assumed that the core corresponds to the long-range ordering and a shell correspond to non-ordered regions where Cu spin did not form a static ordering. We are now investigating how to control oxygen deficiencies that affect magnetic interaction in LCO. In our presentation, detailed μSR results and some characterizations of magnetic properties in LCO nanoparticles will be reported.

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